Remarks/Arguments

Applicants thank Examiner Nyugen for his careful examination of this application and the clear explanation of the rejections. Applicant respectfully submits that because neither the Tomura patent nor the Grabbe patent application discloses all the elements in the claims, they do not anticipate the claims; therefore the rejections are improper:

Claim 13

Claim 13 describes a semiconductor assembly that includes:

(a) a IC that has a plurality of metallic sockets arrayed on a mounting surface;

(b) a PCB that has a plurality of metallic projections arrayed on a mounting surface;

(c) the PCB and IC are so positioned that the plurality of the sockets adjoin the plurality of the projections; and

(d) a plurality of solder joints that couple the IC sockets adjoining the PCB projections.

The Tomura Patent

The Office Action notes that reference 5 in fig. 8 reads on the metallic socket element in claim 13. But a close reading of the Tomura patent makes it clear that reference 5 can not be a metallic socket; therefore the Tomura patent does not disclose at least elements (a), (c), and (d). The detailed description of reference 5 starts on column 7 in the Tomura patent and ends on column 11:

> ...In each concave portion, one of a plurality of contact electrodes 5 is buried in such a manner that the contact electrodes 5 are in contact with the electrodes on the circuit substrate. In the present example, the contact electrodes 5 project from the lower face of the carrier body 1 by about 10μm to about 20μm. However, the contact electrodes 5 do not need to project from the lower face of the carrier body 1 in cases where the electrodes of the circuit substrate have a two-step convex structure, which will be described later.[1]
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> * * *

One of the important features of the chip carrier 12 and the chip package

[1] US 5,628,919, col. 7, ll.39-48.

19 according to the present invention is that the contact electrodes 5 of the chip carrier 12 are formed of a conductive adhesive filling the concave portions of the carrier body 1.[2]

* * *

Moreover, such contact electrodes 5 can be easily connected to any of the projection electrodes of the circuit substrate. By inserting the projection electrodes of the circuit substrate into the contact electrodes 5 of the chip package 19, problems such as creeping-up of the adhesive and short-circuiting between the projection electrodes can be prevented relatively easily.[3]

* * *

After sintering has been conducted, terminal electrodes 6 are formed on an upper face of the carrier body 1, as shown in FIG. 5H. Next, as shown in FIG. 5I, a conductive adhesive is buried in the plurality of concave portions 2b disposed on a face of the carrier body 1 that opposes a circuit substrate by being printed through a print mask 14. Squeegees 13 are used for the printing process. Thus, the conductive adhesive is buried in the concave portions 2b of the carrier body 1, so as to form contact electrodes 5. The conductive adhesive may have flexibility. The conductive adhesive includes conductive particles; the conductive particles are preferably formed of AgPd, Au, Ag, Cu or a complex alloy powder.

The contact electrodes 5 filling the concave portions 2b may or may not project from the carrier body 1. In the case where the contact electrodes 5 do not project from the carrier body 1, electrodes provided on the circuit substrate are required to have a shape insertable into the concave portions 2b of the carrier body 1.

In the case where the carrier body 1 is formed by the above-mentioned method, the length of each contact electrode 5, i.e., the size thereof along a direction perpendicular to the lower face of the carrier body 1, is determined in accordance with the thickness of the green sheet 1b constituting the lowermost layer of the carrier body 1. If the green sheet 1b has a thickness of 150μm after the sintering, each contact electrode 5 has a length in the range of 150μm to 170μm. If the length of each contact electrode 5 is increased, the relatively large electrical resistance component which the contact electrodes 5 have becomes unnegligible. Therefore, the length of the contact electrodes 5 is preferably maintained equal to or smaller than about 200μm.[4]

* * *

Thereafter, the terminal electrodes 18 are inserted into the concave portions of the chip package 19. The contact electrodes 5 are previously filled in the concave portions of the chip package 19. Then, the conductive adhesive

[2] Ibid. col. 8, ll. 32-36.
[3] Ibid. col. 8, ll. 45-51.
[4] Ibid. col. 9, l. 15 – col. 10, l. 17.

> constituting the contact electrodes 5 is cured at 50.degree C to 150.degree C. Thus, the contact electrodes 5 are electrically/mechanically connected to the terminal electrodes 18, whereby the chip package 19 is mounted on the circuit substrate 17.[5]

From the above description, it is clear that the element 5 in the Tomura patent is a flexible contact electrode, made of conductive particles, preferably AgPd, Au, Ag, Cu or a complex alloy powder. It is screen-printed with a squeegee onto the chip carrier and filling the via-holes in the carrier. It may protrude from the surface of the carrier, as depicted in figs 1, 2, 3, 4, 5E, 5I and 8. However, at no time is the element 5 described as a socket. The contact between the contact electrode 5 and the terminal electrode 18 is by the insertion of the electrode 18 into the flexible, adhesive material 5 and the subsequent curing process.

Examiner may read the claims under examination broadly; but applicants respectfully submit that to read element 5 of the Tomura patent as a socket is not being faithful to the teaching of the Tomura patent.

Because it is clear that the Tomura patent does not disclose a metallic socket in its chip carrier, it does not anticipate claim 13; and therefore claim 13 stands patentable over the Tomura patent.

The Grabbe Patent Application

The Grabbe patent application discloses an electrical connector or connection with concave ball-receiving site. The Office Action notes that the abstract and fig. 2 discloses an IC chip 40, a metallic socket 44, metallic projection 52. However, a close reading of the patent reveals the clear fact that the Grabbe patent application fails to disclose all the elements in claim 13, in particularly, it does not disclose a PCB having a plurality of metallic projections arrayed on a mounting surface.

In page 4 of the Grabbe patent application, the assembly of the module 40 to the printed circuit board 50 is described in detail:

> Assembly of the module 40 to the printed circuit board 50 will now be

[5] Ibid. col. 11, ll.50-61.

> described in greater detail. First the pads 52 and contact sites 42 are coated with a low melting point solder. Next, the module 40 is populated with balls 30 such that one ball 30 is positioned and soldered inside each of the concave areas 44. The printed circuit broad 50 is then placed over module 40 such that the array of balls 30 contact respective solder coated pads 52. The entire assembly is then heated to a temperature that would allow the solder to melt and form fillets 34. The entire assembly is then cooled and electrical connection is therefore established between each pad 52 and its respective contact site 42.[6]

It is clear from the description that the Grabbe application discloses a step of soldering the metallic projection 52 inside the concave area 44 of the module 40 before affixing the module 40 to the PCB. The PCB has only planar solder-coated pads 52 on it. Therefore, the element of PCB having a plurality of metallic projections arrayed on a mounting surface is missing from the Grabbe patent application and as a result, the element (c) of claim 13 - the PCB and IC are so positioned that the plurality of the sockets adjoin the plurality of the projections is also missing.

Because both the Tomura patent and the Grabbe application do not have all the elements in claim 13, they do not anticipate claim 13; and therefore claim 13 stands patentable over the Grabbe application.

Claim 19

Claim 19 describes a BGA assembly. It has the two elements of a IC having a plurality of metallic sockets arrayed on a mounting surface not disclosed in the Tomura patent, and a PCB having a plurality of metallic projections arrayed on a mounting surface not disclosed in the Grabbe application; as explained relating to claim 13. Because the cited references do not disclose all the elements in claim 19, they do not anticipate claim 19; and therefore claim 19 stands patentable over the Tomura patent and the Grabbe application.

Claims 14-18 and Claims 20-24

Claim 14-18 properly depend from claim 13 with additional elements of limitation. In particular, claim 14 further limits the solder joints to be detachable; claims 15, 16, and

[6] GB 2 325 354 A, p. 4, ll. 24-36.

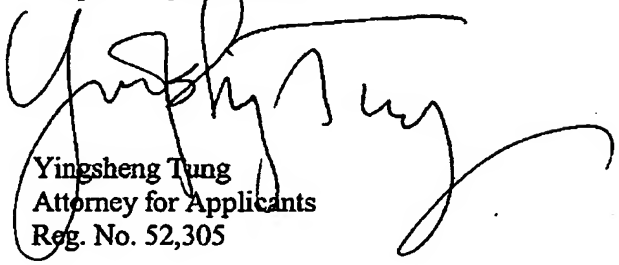
18 further limit the property of the solders in the assembly; and claims 17 and 18 further limit the material of the projection on the PCB.

Claim 20-24 properly depend from claim 19 with additional elements of limitation. In particular, claim 20 further limits the solder joints to be detachable; claims 21, 22, and 24 further limit the property of the solders in the assembly; and claims 23 and 24 further limit the material of the projection on the PCB.

Because of the dependence of claim 14-18 from claim 13 and the dependence of claim 20-24 from claim 19; and because of the additional limitations no disclosed in the references, claims 14-18 and 20-24 also stand patentable over the references.

In summary, applicants respectfully submit that the application is in allowable form and the pending claims distinguish over the cited references and stand patentable. Applicants respectfully request further examination of this application and timely allowance of the pending claims.

Respectfully submitted,



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